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Physics Is Too for Girls

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During the month of May, 1967, twenty-three girls who were just completing their sophomore year of high school were interviewed concerning their science enrollment for the next school year. A typical conversation went as follows:

"Miss Nelson, I see you have signed up for 'regular' chemistry next year. Why didn't you take the Chem-Study course?"

"I'm planning to be a nurse and my counselor said that Chem-Study would be too hard and the regular would be better."

"What science course do you plan to take during your senior year?"

"None."

"Why none?"

"The only one left is physics and I don't want that."

"Why not take physics?"

(The following five answers or combinations of the five came up in every conversation.)

"1.) It's too hard. 2.) I don't know what it is. 3.) I'm not smart enough. 4.) Only brains take that course. 5.) What good would it do me?"

"Would you be interested in taking the physics course next year if I told you that physics is a good course to help you with your chemistry and that there would be no boys in the class, just girls like yourself?"

"I'm not sure. Just what is physics and how could I pass the course? I'm not a brain."

After a few more minutes of explaining my philosophy that physics is for everyone; that they wouldn't need any more math than they would have needed for chemistry; and that they would be participating in this unique experiment of a segregated class with "lady physicists" as guest lecturers, all twenty-three girls signed up for physics.

On the first day of school in the fall of 1967, twenty-one junior girls were sitting in front of me. One of the original twenty-three had moved during the summer and one was lost to the school orchestra which met the same period. During the ten years I have taught physics, this was the most beautiful physics class I'd ever faced and, at the same time, the biggest challenge.

For several years there has been concern about the lack of girls in physics classes and, more recently, the lack of boys. The idea for an all-girl class has been in the back of my mind for some time because just watching the few girls in my physics classes each year gave me the impression that they weren't really enjoying themselves. I felt that *if* an all-girl class could succeed, the word-of-mouth idea that

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physics is fun and interesting would attract boys as well as girls to the classroom again.

Like many teachers, I had placed a girl and boy together to work as laboratory partners. The girl soon assumed the "proper female role," that of secretary, recording all the data and watching the boy manipulate the equipment. Once in awhile a girl would come in after school and ask why her partner was so dumb. When asked why she didn't set it up and let him record the data—"Oh, I couldn't do that. It wouldn't be *right*" (implying that suggestions must be made subtly or the boy would get mad, since girls aren't supposed to be smarter than boys—especially in physics.)

The grouping of girls in a laboratory group is even worse—for the most part. They seem to become completely helpless and require help from a boys' group nearby. Only the girls already known as "class brains" have the freedom of doing their own work. In fact, they are almost completely on their own.

Being the only male in the classroom kept me rather busy seeing that all of the equipment was working in the proper fashion but, by the end of the year, I had noticed considerably more self-assurance in this regard. The girls had learned that it is not only "safe" to touch the electrical wires but also "natural" to hook them up in the proper manner.

In order to have a valid test, the girls would have to be given the same course the boys were taking. The course could not use a different book or be made easier in any way. From the first, it was desirable to give the G.P.C. (girls physics class) the same assignments and laboratory experiments that the regular classes were getting. This was the initial failure on the part of the teacher. Almost all of the seniors were in advanced math classes while the girls, for the most part, were not taking any more math unless it was Algebra II or Plane and Solid Geometry. Many of the girls were only achieving C's and D's for earlier math grades while the seniors had been achieving A's and B's, in these same courses.

The girls felt my disappointment when the results of the first test proved disastrous. Power of ten notation, significant figures, order of magnitude, etc., just had not gotten through.

Having sensed my disappointment, an anonymous student left the following message on the lecture table the next morning.

T.T.T.

Put up in place where it's easy to see
The cryptic admonishment T.T.T.
When you feel how depressingly slowly you climb,
It's well to remember that Things Take Time.

T.T.T. was an important lesson for me as a teacher. Since that time, the letters T.T.T. on the chalkboard have become a permanent reminder.

Through the use of the Chem-Study program materials and short "confidence building" quizzes in which it was certain that everyone would get one of the two questions right, the girls and their teacher have come a long way. All that was really needed was to break down the fear of physics, build up their confidence, and

show some understanding of their problems.

The class average after the first E.T.S. prepared P.S.S.C. test was 13 while the seniors averaged 18 (Series O test #1). Since all three series of tests are available in the department, the series N tests are used for make-up exams. It has been a standing policy that a student could retake a test for an average score between the two results. If, after taking the make-up test, the student felt he had done no better, the test could be marked for no credit. Knowing that there were two chances on each major test gave them confidence. Although no class time was used to go over a test, we took as much time as needed after school for review and/or make-up tests.

The results of the second E.T.S.-prepared test showed a G.P.C. median of 16 while the seniors averaged 18 (Series O test #3). Error analysis of the test revealed that the questions missed by the girls were those involving mathematical sophistication rather than those involving physics concepts.

This class, with its limited math background, had made it virtually impossible to teach a formal course filled with matnematical derivations and arithmetic manipulations, and one was forced to emphasize the physical concepts without formal rigor. I have, at times, found it easier to hide behind a smoke screen of mathematical vocabulary than to really explain nature through the concepts of physics. "Can't you teach this 'stuff' without being so stuffy?" Questions like this often remind me that my emphasis can be misplaced. The *understanding of physics* does not seem to be unduly impaired.

These girls went on to complete the entire book, taking all the E.T.S. tests with class averages ranging from 13 to 18. The important thing to me was their attitude at the end of the course. Physics *was* fun and not as hard as they had been led to believe.

This year (1968-69) there is another class of "girls physics." They, too, are enjoying themselves and finding physics fun and interesting.

We conclude that physics is *too* for girls!